CLAIMS

What is claimed is:

1. A transmission device comprising:

a first rotational member configured for attachment to a means for rotating said first rotational member about a center of rotation;

a first translational member configured for transmitting force to a means for using said force;

connecting means for operatively connecting the first rotational member and the first translational member such that movement of one of said translational member and rotational member causes movement of the other of said translational member and rotational member, wherein a portion of the connecting means is pivotally connected to the first rotational member at a first radial attachment point removed from the center of rotation of said first rotational member such that said first radial attachment point and said center of rotation define a first attachment radius; and

adjusting means for varying a location of the first radial attachment point with respect to the first rotational member to thereby increase and decrease the first attachment radius.

2. The transmission device of claim 1, wherein the adjusting means further comprises means for varying the

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location of the first radial attachment point during rotation of the first rotational member.

3. The transmission device of claim 1, wherein the first rotational member includes a moveable portion, and wherein the second portion of the connecting arm is pivotally connected to said moveable portion, and wherein the adjusting means further comprises means for moving said moveable portion.

4. The transmission device of claim 1, wherein the first rotational member includes a perimeter defining an interior area, and wherein less than a majority of said interior area comprises an opening.

5. The transmission device of claim 1, further comprising:

a second rotational member; and

unidirectional clutch means for (i) engaging the second rotational member in rotational movement when the first rotational member rotates in a first rotational direction and (ii) releasing the second rotational member from engagement in rotational movement when said first rotational member rotates in a second, opposing rotational direction.

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6. The transmission device of claim 1, wherein the first rotational member includes a first side and an opposing second side, the connecting arm being pivotally connected to the first side of said first rotational member, the transmission device further comprising:

a second translational member and a second connecting arm having a first portion pivotally connected to the second translational member and a second portion pivotally connected to the second side of the first rotational member at a second radial attachment point removed from the center of rotation of said first rotational member, such that said second radial attachment point and said center of rotation define a second attachment radius;

wherein the adjusting means further includes means for varying a location of the second radial attachment point to thereby increase and decrease the second attachment radius.

7. The transmission device of claim 6, further comprising:

a second rotational member and a third rotational member; and

unidirectional clutch means for (i) engaging the second rotational member in rotational movement when the first rotational member rotates in a first rotational direction and (ii) releasing the second rotational member from engagement

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with the first rotational member when said first rotational member rotates in a second, opposing rotational direction, and (iii) engaging the third rotational member in rotational movement when the first rotational member rotates in the second, opposing rotational direction and (iv) releasing the third rotational member from engagement with the first rotational member when said first rotational member rotates in the first rotational direction.

8. The transmission device of claim 7, wherein the first and second radial attachment points are diametrically positioned to cause the first and second translational members to move in opposing directions.

9. The transmission device of claim 7, wherein the first and second radial attachment points define a first pivot axis and a second pivot axis, respectively, and wherein the center of rotation of the first rotational member defines a center axis;

wherein positioning of the first pivot axis, second pivot axis and center axes is such that the first pivot axis and the second pivot axis are offset from the center axis by a first and second radial distance, respectively, and such that a first line connecting the first pivot axis with the center axis and a second line connecting the second pivot axis with

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the center axis define an approximately 180° angle about said center axis, such that said positioning cooperates with the unidirectional clutch means to cause reciprocating, back-and-forth rotational movement of the second rotational member and reciprocating, back-and-forth rotational movement of the third rotational member opposite in direction to the rotational movement of the second rotational member.

10. The transmission device of claim 9, wherein the adjusting means further includes means for maintaining the first radial distance substantially equivalent to the second radial distance.

11. The transmission device of claim 1, wherein the first rotational member includes a movement piece having a female-threaded throughpassage formed therein, wherein the adjusting means further comprises:

mass means movably disposed on the first rotational member for moving radially outwardly and inwardly along said first rotational member;

at least one male-threaded member rotatably disposed on the first rotational member and extending through the throughpassage of the movement piece in threaded engagement therewith;

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actuating means for rotating the male-threaded member responsive to radially-directed movement of the mass means along the first rotational member to thereby cause dynamic thread-to-thread engagement of said male-threaded member with female threads of the female-threaded throughpassage sufficient to cause radially-directed movement of the movement piece along the first rotational member, and thus variation in the location of the first radial attachment point with respect to the first rotational member.

12. The transmission device of claim 11, wherein the actuating means comprises:

gear teeth formed on the male-threaded member; and

a gear body coupled to the mass means and extending outwardly therefrom, said gear body having gear teeth disposed in meshing engagement with the gear teeth on the male-threaded member.

13. The transmission device of claim 1, wherein movement of the first translational member and movement of the first rotational member define a first ratio of movement of said first rotational member to said first translational member, and wherein the adjusting means further comprises means for varying the location of the first radial attachment point without varying a location of the first pivot point relative

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to the first translational member to thereby change the first ratio of movement to a second ratio of movement.

14. The transmission device of claim 1, wherein the adjusting means further comprises means for continuously varying the location of the first radial attachment point to thereby continuously vary a first ratio of movement of the first rotational member to the first translational member.

15. The transmission device of claim 1, wherein the adjusting means comprises a hydraulic cylinder.

16. The transmission device of claim 1, wherein the translational member comprises an elongate rack gear having gear teeth arranged in a substantial linear orientation.

17. The transmission device of claim 16, wherein the rack gear comprises a first side and an opposing second side, and wherein the gear teeth extend outwardly from the first side such that the second side is characterized by an absence of gear teeth.

18. The transmission device of claim 1, further comprising:

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a rotational gear member disposed in meshing engagement with the translational member.

19. The transmission device of claim 1, further comprising lengthening means for varying a length of the connecting arm.

20. The transmission device of claim 19:

wherein a reference member resides in a substantially fixed location with respect to a center of the first rotational force-transmitting member;

wherein the second force-transmitting member comprises a first translational member confined to a cycle of reciprocating linear movement toward and away from the reference member responsive to rotational movement of the first, rotational force-transmitting member, wherein the cycle of reciprocating linear movement is defined between a distal position and a proximal position of said first translational member;

wherein the adjusting means further comprises means for varying the length of the connecting arm sufficient to maintain the distal position of the cycle of reciprocating linear movement in substantially the same location with respect to the reference member.

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21. The transmission device of claim 20, wherein the connecting arm and the lengthening means collectively comprise a male-threaded cylindrical member threadably engaged within a female-threaded sleeve, said male-threaded cylindrical member having a longitudinal axis and being rotatable with respect to the female-threaded sleeve about said longitudinal axis.

22. The transmission device of claim 1, further comprising an engine cylinder, wherein the first translational member comprises a piston member slidably disposed within the engine cylinder.

23. The transmission device of claim 1, wherein the connecting means comprises a first connecting arm having a first portion pivotally connected to the first translational member at a first pivot point, and a second portion pivotally connected to the first rotational member at a first radial attachment point removed from the center of rotation of said first rotational member such that said first radial attachment point and said center of rotation define a first attachment radius.

24. The transmission device of claim 1, wherein the connecting means comprises:

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a first connecting arm having a first portion, and a second portion pivotally connected to the first rotational member; and

a second connecting arm having a first portion pivotally connecting to the first portion of the first connecting arm, and an opposing second portion slidably connected to the first translational member;

wherein an interior portion of the second connecting arm is pivotally attached to a fulcrum point such that movement of the first portion of the second connecting arm in a first direction causes corresponding movement of the second portion of said second connecting arm in a second, opposing direction.

25. The transmission device of claim 24, wherein the second connecting arm is an elongate member defining an axial direction, said transmission device further comprising means for moving the fulcrum point along the axial direction of the second connecting arm to thereby modify a range of movement of said second connecting arm.

26. A transmission device comprising:

a first rotational member configured for attachment to a means for rotating said first rotational member about a center of rotation;

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a first translational member configured for transmitting force to a means for using said force;

connecting means for operatively connecting the first rotational member and the first translational member such that movement of one of said translational member and rotational member causes movement of the other of said translational member and rotational member, wherein the connecting means comprises a first connecting arm having a first portion, and a second portion pivotally connected to the first rotational member, and a second connecting arm having a first portion pivotally connecting to the first portion of the first connecting arm, and an opposing second portion slidably connected to the first translational member, and wherein an interior portion of the second connecting arm is pivotally attached to a fulcrum point such that movement of the first portion of the second connecting arm in a first direction causes corresponding movement of the second portion of said second connecting arm in a second, opposing direction.

27. The transmission device of claim 26, wherein the second connecting arm is an elongate member defining an axial direction, said transmission device further comprising means for moving the fulcrum point along the axial direction of the second connecting arm to thereby modify a range of movement of said second connecting arm.

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28. The transmission device of claim 26, wherein the second portion of the first connecting arm is pivotally connected to the first rotational member at a first radial attachment point removed from the center of rotation of said first rotational member such that said first radial attachment point and said center of rotation define a first attachment radius, and wherein the transmission device further comprises:

adjusting means for varying a location of the first radial attachment point with respect to the first rotational member to thereby increase and decrease the first attachment radius.

29. A transmission device comprising:

a first, rotational, force-transmitting member configured for attachment to a means for rotating said first rotational member;

mass means movably disposed on the first rotational member for moving radially outwardly and inwardly along said first rotational member responsive to increases and decreases in rotational velocity, respectively, of said first rotational member;

a second force-transmitting member;

connected to the first, rotational force-transmitting member; and

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connecting means for (i) connecting the first, rotational force-transmitting member to the second force-transmitting member in a manner sufficient to cause said second force-transmitting member to engage in movement responsive to movement of said first, rotational force-transmitting member at a first ratio of movement of said first, rotational force-transmitting member to said second force transmitting member, and (ii) changing the first ratio of movement to a second ratio of movement responsive to movement of the mass means along the first, rotational force-transmitting means.

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~~30~~. The transmission device of claim ~~29~~, wherein the first rotational member includes a movement piece having a female-threaded throughpassage formed therein, wherein the adjusting means further comprises:

at least one male-threaded member rotatably disposed on the first rotational member and extending through the throughpassage of the movement piece in threaded engagement therewith;

actuating means for rotating the male-threaded member responsive to radially-directed movement of the mass means along the first rotational member to thereby cause dynamic thread-to-thread engagement of said male-threaded member with female threads of the female-threaded throughpassage sufficient to cause radially-directed movement of the movement

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piece along the first rotational member, and thus variation in the location of the first radial attachment with respect to the first rotational member.

31. The transmission device of claim 30, wherein the actuating means comprises:

gear teeth formed on the male-threaded member; and

a gear body coupled to the mass means and extending outwardly therefrom, said gear body having gear teeth disposed in meshing engagement with the gear teeth on the male-threaded member.

32. A transmission device comprising:

a first, rotational, force-transmitting member configured for attachment to a means for rotating said first rotational member;

a second force-transmitting member;

a connecting arm having a first portion pivotally connected to the first, rotational force-transmitting member at a first pivot attachment point, and a second portion pivotally connected to the second force-transmitting member at a second pivot attachment point, in a manner sufficient to cause said second force-transmitting member to engage in movement responsive to movement of said first, rotational force-transmitting member at a first ratio of movement of said

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first, rotational force-transmitting member to said second force transmitting member; and

adjusting means for (i) varying a location of one of the pivotal attachment points to thereby increase and decrease the first ratio of movement, and (ii) varying a length of the connecting arm responsive to the varying of the location of said one of the pivotal attachment points.

33. The transmission device of claim 32, wherein the connecting arm and the lengthening means collectively comprise a male-threaded cylindrical member threadably engaged within a female-threaded sleeve, said male-threaded cylindrical member having a longitudinal axis and being rotatable with respect to the female-threaded sleeve about said longitudinal axis.

34. The transmission device of claim 32:

wherein a reference member resides in a substantially fixed location with respect to a center of the first rotational force-transmitting member;

wherein the second force-transmitting member comprises a first translational member confined to a cycle of reciprocating linear movement toward and away from the reference member responsive to rotational movement of the first, rotational force-transmitting member, wherein the cycle

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of reciprocating linear movement is defined between a distal position and a proximal position of said first translational member;

wherein the adjusting means further comprises means for varying the length of the connecting arm sufficient to maintain the distal position of the cycle of reciprocating linear movement in substantially the same location with respect to the reference member.

35. A transmission device comprising:

a first rotational member configured for attachment to a means for rotating said first rotational member about a center of rotation;

a first translational member configured for transmitting force to a means for using said force;

a first connecting arm having a first portion pivotally connected to the first translational member at a first pivot point, and a second portion pivotally connected to the first rotational member at a first radial attachment point removed from the center of rotation of said first rotational member such that said first radial attachment point and said center of rotation define a first attachment radius;

adjusting means for varying a location of the first radial attachment point with respect to the first rotational

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member to thereby increase and decrease the first attachment radius;

wherein the adjusting means further comprises means for varying the location of the radial attachment point during rotation of the first rotational member;

wherein the first rotational member includes a perimeter defining an interior area, and wherein less than a majority of said interior area comprises an opening;

wherein movement of the first rotational member and movement of the first translational member define a first ratio of movement of said first rotational member to said first translational member, and wherein the adjusting means further comprises means for varying the location of the radial attachment point without varying a location of the first pivot point relative to the first translational member to thereby change the first ratio of movement to a second ratio of movement;

wherein the adjusting means further comprises means for continuously varying the location of the first radial attachment point to thereby continuously vary a first ratio of movement of the first rotational member to the first translational member.

36. The transmission device of claim 35, further comprising:

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a second rotational member;

unidirectional clutch means for (i) engaging the second rotational member in rotational movement when the first rotational member rotates in a first rotational direction and (ii) releasing the second rotational member from engagement in rotational movement when said first rotational member rotates in a second, opposing rotational direction;

wherein the first rotational member includes a movement piece having a female-threaded throughpassage formed therein, wherein the adjusting means further comprises:

mass means movably disposed on the first rotational member for moving radially outwardly and inwardly along said first rotational member;

at least one male-threaded member rotatably disposed on the first rotational member and extending through the throughpassage of the movement piece in threaded engagement therewith;

actuating means for rotating the male-threaded member responsive to radially-directed movement of the mass means along the first rotational member to thereby cause dynamic thread-to-thread engagement of said male-threaded member with female threads of the female-threaded throughpassage sufficient to cause radially-directed movement of the movement piece along the first rotational member, and thus variation in the location of

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the first radial attachment with respect to the first rotational member;

wherein the actuating means comprises:

gear teeth formed on the male-threaded member; and

a gear body coupled to the mass means and extending outwardly therefrom, said gear body having gear teeth disposed in meshing engagement with the gear teeth on the male-threaded member;

wherein the adjusting means comprises a hydraulic cylinder;

wherein the translational member comprises an elongate rack gear having gear teeth arranged in a substantial linear orientation;

wherein the rack gear comprises a first side and an opposing second side, and wherein the gear teeth extend outwardly from the first side such that the second side is characterized by an absence of gear teeth;

wherein the device further comprises a rotational gear member disposed in meshing engagement with the translational member.

37. A method for transmitting force among gear members and varying a gear ratio of movement said gear members, said method comprising the steps of:

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(a) pivotally connecting a first portion of a connecting arm to a first translational member at a first pivot point, and pivotally connecting a second portion of the connecting arm to a first rotational member at a first radial attachment point removed from a center of rotation of the first rotational member such that said first radial attachment point and said center of rotation define a first attachment radius, such that dynamic force from rotational movement of the first rotational member is transmitted by the connecting arm to the first translational member; and

(b) varying a location of the first radial attachment point with respect to the first rotational member to thereby increase and decrease the first attachment radius and change a first ratio of movement of said first rotational member to the first translational member.

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